



DECLARATION

I, Won JEON, Korean Patent Attorney of 5F, Seil Building, 727-13, Yoksam-dong, Gangnam-gu, Seoul, Korea do hereby solemnly and sincerely declare as follows:

1. That I am well acquainted with the English and Korean languages.
2. That the following is a correct translation into English of the accompanying certified copy of a Korean Patent Application No. 2003-20598.

and I make the solemn declaration conscientiously believing the same to be true.

Seoul, April 11, 2007

A handwritten signature in cursive script that reads "Won Jeon". The signature is written in black ink and is positioned above a horizontal line.

Won JEON



**THE KOREAN INDUSTRIAL
PROPERTY OFFICE**

This is to certify that annexed hereto is a true copy from the records of the Korean Industrial Property Office of the following application as filed.

Application Number : Patent Application No. 2003-20598

Date of Application : April 1, 2003

Applicant : Samsung Electronics Co., Ltd.

Dated this: April 15, 2003

COMMISSIONER

PATENT APPLICATION

Applicant : Name: Samsung Electronics Co., Ltd.
(Representative: Jong-Yong YUN)

Address : 416, Maetan-dong, Paldal-gu, Suwon-si, Gyeonggi-do,
Republic of Korea

Agent(s) : Young-Woo PARK

Inventor(s) : Name : Yong-Ho, YANG
: Address : 108-1510 Hyundai Apt., Sinrim2-dong, Gwanak-gu,
Seoul, Republic of Korea

Inventor(s) : Name : Kyo-Seop, CHOO
: Address : 130-306 Hwanggolmaeul Jugong 1danji Apt.,
Yeongtong-dong, Paldal-gu, Suwon-si, Gyeonggi-do,
Republic of Korea

Inventor(s) : Name : Jin-Suk, PARK
: Address : 302-1507 Cheonggu Apt., Hongje4-dong,
Seodaemun-gu, Seoul, Republic of Korea

Title of the Invention : Liquid Crystal Display Apparatus And Method Of
Manufacturing The Same

Dated this: April 1, 2003

To the COMMISSIONER



[ABSTRACT]

[ABSTRACT]

In an LCD apparatus capable of improving display quality, the LCD apparatus includes a lower substrate, an upper substrate, a spacer maintaining a gap between the lower and upper substrates and a liquid crystal interposed between the lower and upper substrates. The lower substrate includes an auxiliary capacitor including first and second auxiliary electrodes spaced apart from each other by an insulating layer and a protecting layer covering the auxiliary capacitor. An auxiliary contact hole that partially exposes the second auxiliary electrode is formed through the protecting layer. The upper substrate is combined with the lower substrate. The spacer is disposed corresponding to the auxiliary capacitor.

[REPRESENTATIVE FIGURE]

FIG. 1

[SPECIFICATION]

[TITLE OF THE INVENTION]

LIQUID CRYSTAL DISPLAY APPARATUS AND METHOD OF MANUFACTURING
THE SAME

[BRIEF EXPLANATION OF THE DRAWINGS]

FIG. 1 is a plan view showing a lower substrate of an LCD apparatus according to another exemplary embodiment of the present invention;

FIG. 2 is a cross-sectional view taken along a line I-I' of a transmissive type LCD apparatus having the lower substrate shown in FIG. 4;

FIG. 3 is a cross-sectional view showing a transmissive type LCD apparatus according to another exemplary embodiment of the present invention;

FIG. 4 is a cross-sectional view showing a transreflective type LCD apparatus according to another exemplary embodiment of the present invention;

FIG. 5 is a cross-sectional view showing a transreflective type LCD apparatus according to another exemplary embodiment of the present invention;

FIG. 6 is a cross-sectional view showing a reflective LCD apparatus according to another exemplary embodiment of the present invention;

FIG. 7 is a cross-sectional view showing a reflective type LCD apparatus according to another exemplary embodiment of the present invention;

FIG. 8 is a cross-sectional view showing an LCD apparatus including column spacers spaced apart from each other according to another exemplary embodiment of the present invention; and

FIGS. 9A to 9F are views illustrating a method of manufacturing an LCD apparatus according to an exemplary embodiment of the present invention.

<EXPLANATION ON CHIEF REFERENCE NUMERALS OF DRAWINGS >

100 : insulating substrate	110 : gate electrode
140 : first auxiliary electrode	210 : source electrode
315 : drain electrode	370 : organic layer
5 411 : transmissive electrode	412 : reflective electrode
500 : black matrix	6000 : LCD apparatus

[DETAILED DESCRIPTION OF THE INVENTION]

[PURPOSE OF THE INVENTION]

10 [THE ART TO WHICH THE INVENTION PERTAINS AND THE PRIOR ART]

The present invention relates to an LCD (Liquid Crystal Display) apparatus and a method of manufacturing the same, and more particularly to an LCD apparatus having an improved display quality and a method of manufacturing the same.

15 In recently, touch screen technologies are widely applied to electronic instruments, for example, such as a PDA (Personal Digital Assistants), a mobile communication system and so on. In an LCD apparatus to which a touch screen panel is applied, a ripple phenomenon appears on an LCD panel of the LCD apparatus when a user touches a surface of the LCD panel. The ripple phenomenon is caused by swelling of a liquid crystal when the user locally and successively touches the surface of the LCD panel.

20 As one of methods in order to prevent the ripple phenomenon, a method that forms a column spacer inside the LCD panel so as to support the LCD panel touched by the user has been developed. However, since the column spacer presently used is uniformly distributed inside the LCD panel, the swelling of the liquid crystal may not be efficiently controlled. This is because the LCD panel may be variously deformed according to positions touched by the user even if the user touches the surface of the LCD apparatus at a uniform force.

25

The ripple phenomenon is caused rippling formed by compressing the LCD panel,

depressing the LCD panel and continuously compressing and depressing the LCD panel.

Therefore, when an area of the column spacer in a unit pixel is increased, the ripple phenomenon is minimized.

However, when the area of the spacer is increased more than a predetermined area,
5 the ripple phenomenon is not decreased less than a predetermined amount.

[TECHNICAL OBJECT OF THE INVENTION]

The present invention provides an LCD apparatus having an improved display quality.

The present invention provides a method suitable for manufacturing the above LCD
10 apparatus.

[CONSTRUCTION AND OPERATION OF THE INVENTION]

In one aspect of the invention, an LCD apparatus includes a lower substrate, an upper substrate and a liquid crystal layer.

The lower substrate includes an auxiliary capacitor and a protecting layer covering
15 the auxiliary capacitor. An auxiliary contact hole through which the auxiliary capacitor is exposed is formed through the protecting layer.

The upper substrate is combined with the lower substrate and includes a spacer disposed corresponding to the auxiliary capacitor so as to uniformly maintain a gap between the upper and lower substrates.

20 Hereinafter, the present invention will be described in detail with reference to the accompanying drawings.

FIG. 1 is a plan view showing a lower substrate of an LCD apparatus according to an exemplary embodiment of the present invention. FIG. 2 is a cross-sectional view showing a transmissive type LCD apparatus having the lower substrate shown in FIG. 1

25 Referring to FIGS. 1 and 2, the lower substrate 5000 that is a thin film transistor substrate includes a gate line 130a and an auxiliary electrode line 130b including aluminum

(Al), aluminum alloy, molybdenum (Mo), molybdenum-tungsten alloy (MoW), chromium (Cr) and tantalum (Ta) that are formed on an insulating substrate 100.

According to the present example embodiment, an auxiliary capacitor is formed through an independent line method. In the independent line method, the auxiliary capacitor includes a first auxiliary electrode 140 and a second auxiliary electrode 313, and each of the first and second auxiliary electrodes 140 and 313 is independently formed.

The first auxiliary electrode 313 is a common line that is formed from a same layer as the gate line, and extended in a direction substantially parallel with the gate line. The second auxiliary electrode 140 is branched from the data line, and is electrically connected to the drain electrode. That is, the first and second auxiliary electrodes 140 and 313 interpose the gate insulating layer 170 to function as the auxiliary capacitor that compensate a capacitance of a liquid crystal capacitor.

In FIG. 1, a gate pattern includes the gate line 130a extended in a first direction and a gate electrode 110 that is from the gate line 130a. A plurality of gate electrodes 110 may be spaced apart from each other. The auxiliary capacitor line 130b is interposed between adjacent gate lines 130a, and is substantially parallel with the gate line 130a. The auxiliary capacitor line 130b receives an externally provided voltage such as a gate voltage, and is overlapped with a pixel electrode 410 to form the auxiliary capacitor that increases the capacitance of a pixel.

Each of the gate line 130a and the auxiliary electrode line 130b may be provided with a single layer, a double layer or a triple layer. In case that the gate pattern is provided with the double or triple layers, one layer includes the chromium (Cr) or the aluminum (Al) and another layer includes the aluminum (Al) or the molybdenum (Mo).

A gate insulating layer 170 comprising a silicon nitride (SiN_x) covers the gate line 130a and the auxiliary electrode line 130b.

A semiconductor layer 320 is formed on the gate insulating layer 170 corresponding

to the gate electrode 110, and an active layer 330 of an island type is formed on the semiconductor layer 320.

A conductive metal layer formed on the gate insulating layer 170 on which the active layer 330 is formed is patterned to form a data line 230 extended in a direction different from the first direction, source-drain electrodes 210 and 315 protruded from the data line 230 and partially overlapped with the active layer 330.

The gate electrode 110, the active layer 330 and the source-drain electrodes 210 and 315 are partially overlapped, and the data line 230 is substantially perpendicular to the gate line 230 when viewed on a rear surface of the insulating substrate 100.

A portion of the source-drain electrodes 210 and 315 overlapped with the gate electrode 110 is etched to form a source electrode 210 and a drain electrode 315. Thus, a thin film transistor 330 is completed. The source electrode 210 is electrically connected to the data line 230, and the source electrode 210 is spaced apart from the drain electrode 315.

An organic layer 370 including a benzocyclobutene (BCB), an acrylic resin, etc., is formed over the source electrode 210 and the drain electrode 315. An auxiliary contact hole 800 is formed on a portion of the drain electrode 315.

The pixel electrode 410 is formed on the drain electrode 315 and the organic layer 370 having the auxiliary contact hole 800. The pixel electrode 410 corresponding to the data line 230 is partially etched to be electrically insulated from a pixel electrode in an adjacent pixel region.

The pixel electrode 410 applies a voltage to a liquid crystal layer 400 sealed between the upper substrate 200 combined with the lower substrate 5000 and the lower substrate 5000. The pixel electrode 410 includes a transparent conductive material, for example, such as an indium tin oxide (hereinafter, referred to as ITO), so as to transmit a light provided from a lower portion of the lower substrate 5000.

When the upper substrate 200 is combined with the lower substrate 5000, a spacer

is used to maintain a cell gap. In the present example embodiment, the organic layer 370 is patterned to form a column spacer 430a.

A position of the column spacer 430a corresponds to that of the auxiliary contact hole 800. In FIG. 2, no material such as an organic layer is interposed between the column spacer 430a and the pixel electrode 410.

As described above, when the column spacer 430a is formed on the auxiliary contact hole 810, the transmissive type LCD apparatus may prevent an opening ratio from being lowered due to the column spacer 430a. Also, the transmissive type LCD apparatus may prevent the upper substrate 200 from being pushed down toward the lower substrate 5000 because the column spacer 430a is formed on the pixel electrode 410.

FIG. 3 is a cross-sectional view showing a transmissive type LCD apparatus according to another exemplary embodiment of the present invention. In FIG. 3, the same reference numerals denote the same elements in FIG. 2, and thus the detailed descriptions of the same elements will be omitted.

Referring to FIGS. 1 and 3, the lower substrate 5000 includes a gate line 130a and an auxiliary electrode line 130b including aluminum (Al), aluminum alloy, molybdenum (Mo), molybdenum-tungsten alloy (MoW), chromium (Cr) and tantalum (Ta).

In the present example embodiment, an auxiliary capacitor is formed through an independent line method. In the independent line method, a first auxiliary electrode 140 and a second auxiliary electrode 313 are used to form the auxiliary capacitor. The first auxiliary electrode is branched from a data line and electrically connected to a drain electrode. The second auxiliary electrode 313 is formed from a same layer as the gate line, and extended in a direction substantially parallel with the gate line. The second auxiliary electrode 313 may be a common line Vcom.

When the upper substrate 200 is combined with the lower substrate 5000, a spacer is used to maintain a cell gap. In the present example embodiment, the organic layer 370 is

patterned to form a column spacer 430b.

A position of the column spacer 430b corresponds to that of the auxiliary contact hole 800. The column spacer 430b is on an entry of the auxiliary contact hole 800, and is supported by the pixel electrode 410. Thus, any material such as an organic layer is not interposed between the column spacer 430b and the pixel electrode 410.

As described above, when the column spacer 430b is formed on the auxiliary contact hole 800, the transmissive type LCD apparatus may prevent an opening ratio from being lowered due to the column spacer 430b. Also, the transmissive type LCD apparatus may prevent the upper substrate 200 from being pushed down toward the lower substrate 5000 because the column spacer 430b is formed on the pixel electrode 410.

FIG. 4 is a cross-sectional view showing a transreflective type LCD apparatus according to another exemplary embodiment of the present invention.

Referring to FIG. 4, the lower substrate 5000 includes a gate line 130a and an auxiliary electrode line 130b including a metal or a conductive material on an insulating substrate 100.

In the present example embodiment, an auxiliary capacitor is formed through an independent line method. In the independent line method, a first auxiliary electrode 140 and a second auxiliary electrode 313 are used to form the auxiliary capacitor. The first auxiliary electrode 140 is branched from a data line and electrically connected to a drain electrode. The second auxiliary electrode 313 is formed from a same layer as the gate line, and extended in a direction substantially parallel with the gate line. The second auxiliary electrode 313 may be a common line Vcom.

The transreflective type LCD apparatus 8000 includes the lower substrate 100, an upper substrate 200 and a liquid crystal layer (not shown) interposed between the lower substrate 100 and the upper substrate 200.

A thin film transistor (TFT) 300 including a gate electrode 110, a source electrode 210

and a drain electrode 315 is formed on the lower substrate 100. An organic layer 371 including a benzocyclobutene (BCB), an acrylic resin, etc., is formed over the source electrode 210 and the drain electrode 315. An auxiliary contact hole 800 is formed on a portion of the drain electrode 315.

5 The organic layer 371 includes an embossing pattern to effectively reflect light, and a pixel electrode 411 and 412 including a reflective electrode 412 and a transmissive electrode 411 is formed on the organic layer 371 having the embossing pattern.

 When the upper substrate 200 is combined with the lower substrate 5000, a spacer is used to maintain a cell gap. In the present example embodiment, the organic layer 371 is
10 patterned to form a column spacer 430a.

 A position of the column spacer 430a corresponds to that of the auxiliary contact hole 800. The column spacer 430a is on an entry of the auxiliary contact hole 800, and is supported by the pixel electrode 411 and 412. Thus, any material such as an organic layer is not interposed between the pixel electrode 411 and 412 and the column spacer 430a.

15 As described above, when the column spacer 430a is formed on the position corresponding to the auxiliary contact hole 800, the transmissive type LCD apparatus may prevent an opening ratio from being lowered due to the column spacer 430a. Also, the transmissive type LCD apparatus may prevent the upper substrate 200 from being pushed down toward the lower substrate 5000 because the column spacer 430a is formed on the
20 pixel electrode 410.

 In addition, the transreflective LCD apparatus includes a black matrix formed on the upper substrate corresponding to the column spacer. The black matrix prevents the column spacer from being displayed on the transreflective LCD apparatus, thereby preventing display quality of the transreflective LCD apparatus from being deteriorated.

25 FIG. 5 is a cross-sectional view showing a transreflective type LCD apparatus according to another exemplary embodiment of the present invention. In FIG. 5, the same

reference numerals denote the same elements in FIG. 4, and thus the detailed descriptions of the same elements will be omitted.

Referring to FIG. 5, the lower substrate 5000 includes a gate line 130a and an auxiliary electrode line 130b including a metal or a conductive material on an insulating substrate 100.

In the present example embodiment, an auxiliary capacitor is formed through an independent line method. In the independent line method, a first auxiliary electrode 140 and a second auxiliary electrode 313 are used to form the auxiliary capacitor. The first auxiliary electrode 140 is branched from a data line and electrically connected to a drain electrode. The second auxiliary electrode 313 is formed from a same layer as the gate line, and extended in a direction substantially parallel with the gate line. The second auxiliary electrode 313 may be a common line Vcom.

A position of a column spacer 430b corresponds to that of an auxiliary contact hole 800. The column spacer 430b is on an entry of the auxiliary contact hole 800, and is supported by the pixel electrode 411 and 412. Thus, any material such as an organic layer is not interposed between a pixel electrode 411 and 412 and the column spacer 430b.

As described above, when the column spacer 430b is formed on the position corresponding to the auxiliary contact hole 800, the transmissive type LCD apparatus may prevent an opening ratio from being lowered due to the column spacer 430b. Also, the transmissive type LCD apparatus may prevent the upper substrate 200 from being pushed down toward the lower substrate 5000 because the column spacer 430b is formed on the pixel electrode 410.

FIG. 6 is a cross-sectional view showing a reflective LCD apparatus according to another exemplary embodiment of the present invention.

Referring to FIG. 6, the lower substrate 5000 that is a thin film transistor substrate includes a gate line 130a and an auxiliary electrode line 130b including a metal or a

conductive material on an insulating substrate 100.

In the present example embodiment, an auxiliary capacitor is formed through an independent line method. In the independent line method, a first auxiliary electrode 140 is branched from a data line and electrically connected to a drain electrode. A second auxiliary electrode 313 is formed from a same layer as the gate line, and extended in a direction substantially parallel with the gate line. The second auxiliary electrode 313 may be a common line Vcom.

The reflective LCD apparatus 10000 includes the lower substrate 100, the upper substrate 200 and a liquid crystal layer (not shown) interposed between the lower substrate 100 and the upper substrate 200.

A thin film transistor (TFT) 300 including a gate electrode 110, a source electrode 210 and a drain electrode 315 is formed on the lower substrate 100. An organic layer 371 including a benzocyclobutene (BCB), an acrylic resin, etc., is formed over the source electrode 210 and the drain electrode 315. An auxiliary contact hole 800 is formed on a portion of the drain electrode 315.

The organic layer 371 includes an embossing pattern to effectively reflect light, and a pixel electrode 416 is formed on the organic layer 371 having the embossing pattern.

When the upper substrate 200 is combined with the lower substrate 5000, a spacer is interposed between the upper substrate 200 and the lower substrate 5000 to maintain a cell gap. In the present example embodiment, the organic layer 371 is patterned to form a column spacer 430a.

A position of the column spacer 430a corresponds to that of the auxiliary contact hole 800. The column spacer 430a is on an entry of the auxiliary contact hole 800, and is supported by the pixel electrode 416. Thus, any material such as an organic layer is not interposed between the pixel electrode 416 and the column spacer 430a.

As described above, when the column spacer 430a is formed on the position

corresponding to the auxiliary contact hole 800, the transmissive type LCD apparatus may prevent an opening ratio from being lowered due to the column spacer 430a. Also, the transmissive type LCD apparatus may prevent the upper substrate 200 from being pushed down toward the lower substrate 5000 because the column spacer 430a is formed on the pixel electrode 416.

In addition, the reflective LCD apparatus includes a black matrix formed on the upper substrate corresponding to the column spacer. The black matrix prevents the column spacer from being displayed on the transreflective LCD apparatus, thereby preventing display quality of the transreflective LCD apparatus from being deteriorated.

FIG. 7 is a cross-sectional view showing a reflective type LCD apparatus according to another exemplary embodiment of the present invention.

Referring to FIG. 7, the lower substrate 5000 that is a thin film transistor substrate includes a gate line 130a and an auxiliary electrode line 130b including a metal or a conductive material on an insulating substrate 100.

In the present example embodiment, an auxiliary capacitor is formed through an independent line method. In the independent line method, a first auxiliary electrode 140 and a second auxiliary electrode 313 are used to form the auxiliary capacitor. The first auxiliary electrode 140 is branched from a data line and electrically connected to a drain electrode. The second auxiliary electrode 313 is formed from a same layer as the gate line, and extended in a direction substantially parallel with the gate line. The second auxiliary electrode 313 may be a common line Vcom.

A thin film transistor (TFT) 300 including a gate electrode 110, a source electrode 210 and a drain electrode 315 is formed on the lower substrate 100. An organic layer 371 including a benzocyclobutene (BCB), an acrylic resin, etc., is formed over the source electrode 210 and the drain electrode 315. An auxiliary contact hole 800 is formed on a portion of the drain electrode 315.

The organic layer 371 includes an embossing pattern to effectively reflect light, and a pixel electrode 416 is formed on the organic layer 371 having the embossing pattern.

When the upper substrate 200 is combined with the lower substrate 5000, a spacer is used to maintain a cell gap. According to the present example embodiment, the organic layer 371 is patterned to form a column spacer 430a.

A position of the column spacer 430a corresponds to that of the auxiliary contact hole 800. The column spacer 430a is on an entry of the auxiliary contact hole 800, and is supported by the pixel electrode 416. Thus, any material such as an organic layer is not interposed between the pixel electrode 416 and the column spacer 430a.

As described above, when the column spacer 430a is formed on the position corresponding to the auxiliary contact hole 800, the transmissive type LCD apparatus may prevent an opening ratio from being lowered due to the column spacer 430a. Also, the transmissive type LCD apparatus may prevent the upper substrate 200 from being pushed down toward the lower substrate 5000 because the column spacer 430a is formed on the pixel electrode 416.

FIG. 8 is a cross-sectional view showing an LCD apparatus having a plurality of column spacers according to an exemplary embodiment of the present invention.

Referring to FIG. 8, a sealant 300 is formed in a peripheral area of the LCD apparatus 600 to increase physical resistance against an externally provided pressure. According to the present example embodiment, a distance between adjacent column spacers 430 in a central area of the LCD apparatus 600 is different from a distance between adjacent column spacers 430 in the peripheral area of the LCD apparatus 600.

The distance between the adjacent column spacers 430 is decreased, as a distance from a side of the LCD apparatus 600 is increased.

FIGS. 9A to 9F illustrate a method of manufacturing an LCD apparatus according to an exemplary embodiment of the present invention.

Referring to FIG 9A, a metal layer, for example, such as aluminum or aluminum alloy, deposited on an insulating substrate 100 is patterned through a first mask process to form a first auxiliary electrode 140. The first auxiliary electrode 140 is separately formed with a gate line or a data line described below. The first auxiliary electrode 140 is formed in an independent line method.

Referring to FIG 9B, a metal layer containing chromium (Cr), molybdenum (Mo), tantalum (Ta) or antimony (Sb) is deposited on the substrate on which the first auxiliary electrode 140 is formed and patterned through a second mask process to form a gate electrode 110 and a gate line. The gate line completely covers the first auxiliary electrode 140. The gate electrode 110 is branched from the gate line 110, and formed on a corner of each of pixels arranged in a matrix shape.

Referring to FIG 9C, a gate insulating layer 170 containing a first inorganic insulating material such as silicon nitride or silicon oxide is formed over the insulating substrate 100 on which the gate electrode 110 is formed. Then, an intrinsic semiconductor, for example, such as amorphous silicon, and an extrinsic semiconductor doped with impurities are successively deposited on the gate insulating layer 170. The extrinsic and intrinsic semiconductors are sequentially patterned through a third mask process to form a semiconductor layer 320 and an active layer 330.

Referring to FIG 9D, a metal layer containing chromium is formed over the insulating substrate 100 and patterned through a fourth mask process to form a source electrode 230, a drain electrode 315, a second auxiliary electrode 140 and a source line. The source electrode 230 is overlapped with an end of the gate electrode 110, and the semiconductor layer 320 and the active layer 330 are interposed between the source electrode 230 and the gate electrode 110. The drain electrode 315 is used as a mask to divide the active layer 330 into two parts. The active layer 330 makes an ohmic contact with the source electrode 230, the source line and the drain electrode 315. A second auxiliary electrode 313 that is

branched from the data line is overlapped the first auxiliary electrode 140 to interpose the gate insulating layer 170, thereby functioning as the auxiliary capacitor to compensate a capacitance of a liquid crystal capacitor.

Referring to FIG. 9E, an organic layer 370 containing an organic insulating material, for example, such as benzocyclobutene (BCB), is formed over the insulating substrate 100 on which the source electrode is formed. The organic layer 370 is patterned through a fifth mask process to form an auxiliary contact hole 800, thereby partially exposing the second auxiliary electrode 313 through the auxiliary contact hole 800.

Referring to FIG. 9F, an indium tin oxide (ITO) is deposited on the organic layer and patterned through a sixth mask process to form a pixel electrode 410. The pixel electrode 410 is electrically connected to the second auxiliary electrode 313 through the auxiliary contact hole 800.

As shown in FIG. 2, a column spacer 430a is formed corresponding to the auxiliary contact hole 800, and any material such as an organic layer is not interposed between the column spacer 430a and the pixel electrode 410.

Alternatively, as shown in FIG. 3, the column spacer 430b may be formed corresponding to an entry of the auxiliary contact hole 800 so that the pixel electrode 410 may support the column spacer 430b. Thus, any material such as an organic layer may not be interposed between the pixel electrode 410 and the column spacer 430b.

As described above, when the column spacers 430a and 430b are formed a region corresponding to the auxiliary contact hole 800, the LCD apparatus may prevent an opening ratio from being lowered due to the column spacers 430a and 430b. Also, the LCD apparatus may prevent the upper substrate 200 from being pushed down toward the lower substrate 5000 because the column spacer 430a is formed on the pixel electrode 410. Thus, display quality may be improved.

[EFFECT OF THE INVENTION]

According to the LCD apparatus and the method of manufacturing the LCD apparatus, a column spacer is formed corresponding to an auxiliary contact hole, so that display quality of the LCD apparatus is improved.

5 Although the exemplary embodiments of the present invention have been described, it is understood that the present invention should not be limited to these exemplary embodiments but various changes and modifications can be made by one ordinary skilled in the art within the spirit and scope of the present invention as hereinafter claimed.

[CLAIMS]

[CLAIMS 1]

An LCD apparatus comprising:

5 a lower substrate having an auxiliary capacitor and a protecting layer that covers the auxiliary capacitor, the protecting layer having an auxiliary contact hole so as to partially expose the auxiliary capacitor;

an upper substrate combined with the lower substrate, the upper substrate having a spacer disposed corresponding to the auxiliary contact hole so as to uniformly maintain a cell gap between the lower and upper substrates; and

10 a liquid crystal interposed between the lower and upper substrates.

[CLAIMS 2]

The LCD apparatus of claim 1, wherein the auxiliary capacitor comprises a first auxiliary electrode and a second auxiliary electrode that are spaced apart from each other by a gate insulating layer.

15 [CLAIMS 3]

The LCD apparatus of claim 2, wherein the second auxiliary electrode is exposed through the auxiliary contact hole.

[CLAIMS 4]

The LCD apparatus of claim 3, wherein the lower substrate comprises:

20 a substrate;

a gate line formed on the substrate and extended in a first direction, the gate line having a gate electrode branched therefrom;

a gate insulating layer for covering the gate line;

25 a data line formed between the gate insulating layer and the protecting layer and extended in a second direction perpendicular to the first direction, the data line having a source electrode and a drain electrode branched therefrom; and

a pixel electrode formed on the protecting layer and electrically connected to the drain electrode by means of the second auxiliary electrode.

[CLAIMS 5]

5 The LCD apparatus of claim 4, wherein the first auxiliary electrode is formed from a same layer as the gate line and extended in the first direction, and the second auxiliary electrode is branched from the data line and electrically connected to the drain electrode.

[CLAIMS 6]

The LCD apparatus of claim 4, wherein the pixel electrode comprises a reflective electrode including a metal.

10 [CLAIMS 7]

The LCD apparatus of claim 6, wherein the first auxiliary electrode comprises a common line formed from a same layer as the gate line and extended in the first direction, and the second auxiliary electrode is branched from the data line and electrically connected to the drain electrode.

15 [CLAIMS 8]

The LCD apparatus of claim 4, wherein the pixel electrode comprises:
a transmissive electrode including indium tin oxide (ITO) or indium zinc oxide (IZO);
and
a reflective electrode formed on the transmissive electrode and including a metal.

20 [CLAIMS 9]

The LCD apparatus of claim 8, wherein the first auxiliary electrode comprises a common line formed from a same layer as the gate line and extended in the first direction, and the second auxiliary electrode is branched from the data line and electrically connected to the drain electrode.

25 [CLAIMS 10]

The LCD apparatus of claim 1, wherein a distance between adjacent spacers is

decreased, as a distance from a side of the upper substrate is increased.

[CLAIMS 11]

The LCD apparatus of claim 1, wherein the upper substrate comprises a block matrix blocking light incident into a region corresponding to the spacer.

5 [CLAIMS 12]

The LCD apparatus of claim 1, wherein the protecting layer comprises benzocyclobutene (BCB).

[CLAIMS 13]

A method of manufacturing an LCD apparatus, comprising:

10 preparing a lower substrate including:

forming a first auxiliary electrode on an insulating substrate;

forming a gate electrode on the insulating substrate;

forming a gate insulating layer over the first auxiliary electrode and the gate electrode;

15 forming a semiconductor layer on the gate insulating layer corresponding to the gate electrode;

forming source-drain electrodes on the semiconductor layer;

forming a second auxiliary electrode on the gate insulating layer corresponding to the first auxiliary electrode;

20 forming the protecting layer covering the auxiliary capacitor; and

forming an auxiliary contact hole through the protecting layer to expose the second auxiliary electrode;

preparing an upper substrate combined with the lower substrate;

25 forming a spacer disposed corresponding to the auxiliary contact hole so as to uniformly maintain a gap between the lower and upper substrates; and

interposing a liquid crystal layer between the lower and upper substrates.

[CLAIMS 14]

The method of claim 13, wherein preparing the lower substrate further comprises:

forming a gate line on the insulating substrate, the gate line being extended in a first direction and having the gate electrode branched therefrom;

5 forming a gate insulating layer covering the gate line;

forming a data line between the gate insulating layer and the protecting layer, the data line being extended in a second direction perpendicular to the first direction and having the source-drain electrodes branched therefrom; and

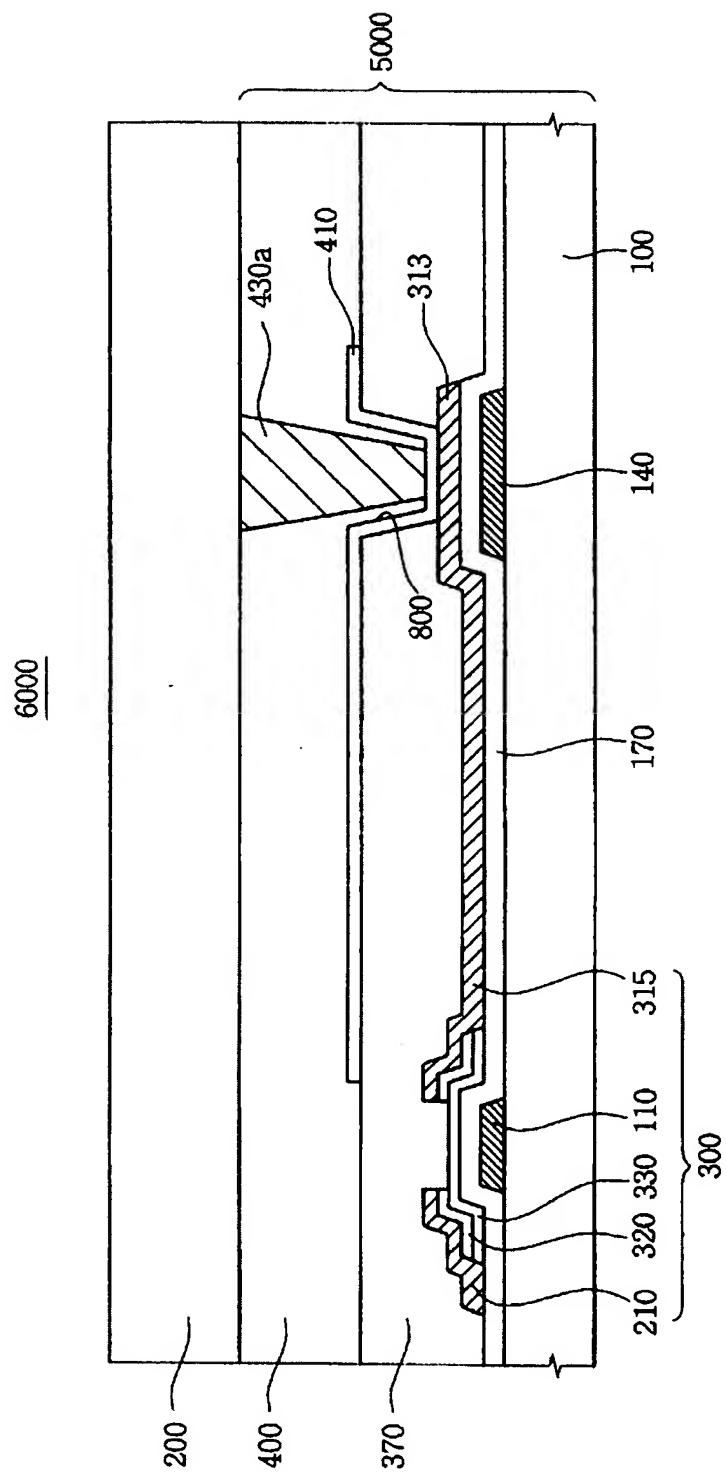
10 forming a pixel electrode on the protecting layer, the pixel electrode being electrically connected to the drain electrode by means of the second auxiliary electrode.

[CLAIMS 15]

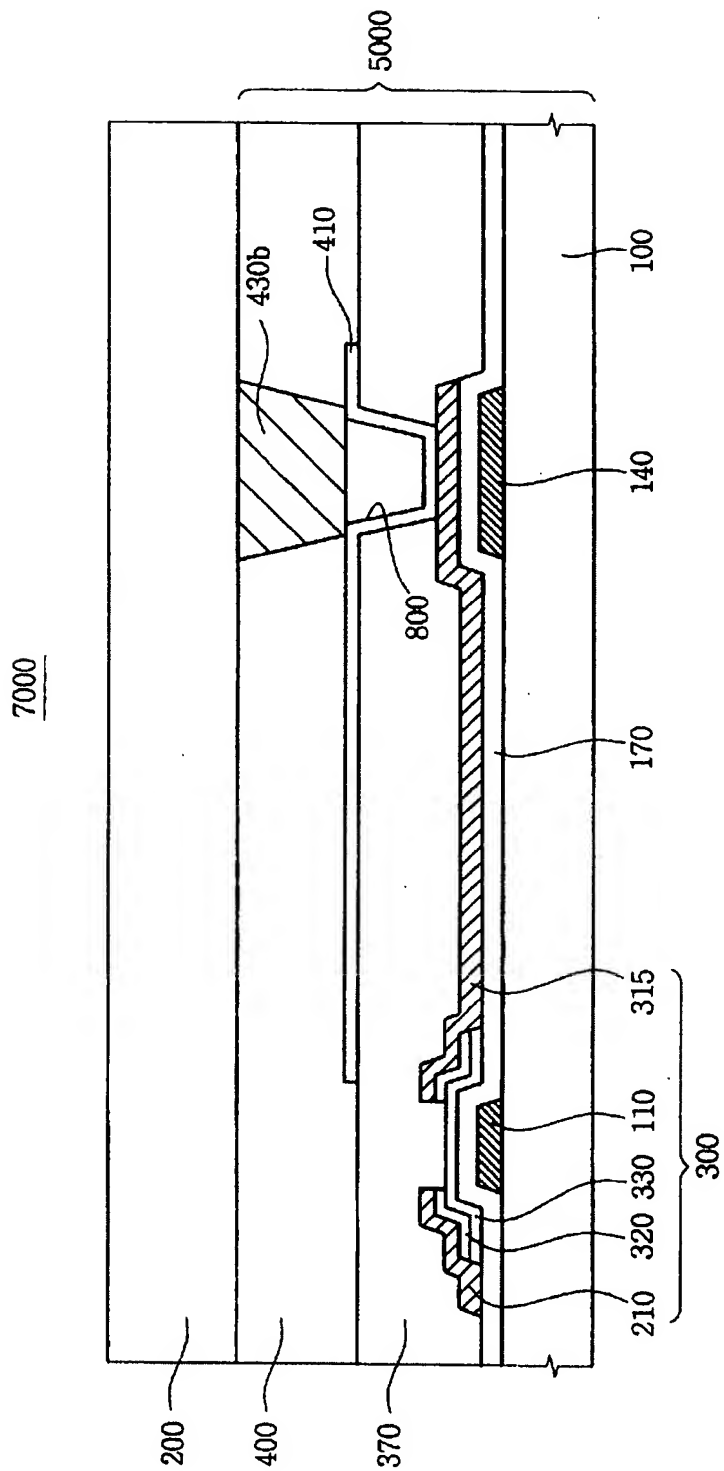
The method of claim 14, wherein the first auxiliary electrode is formed on a same layer as the gate line and extended in a same direction as the gate line, and the second auxiliary electrode is extended from the data line and electrically connected to the drain electrode.

15

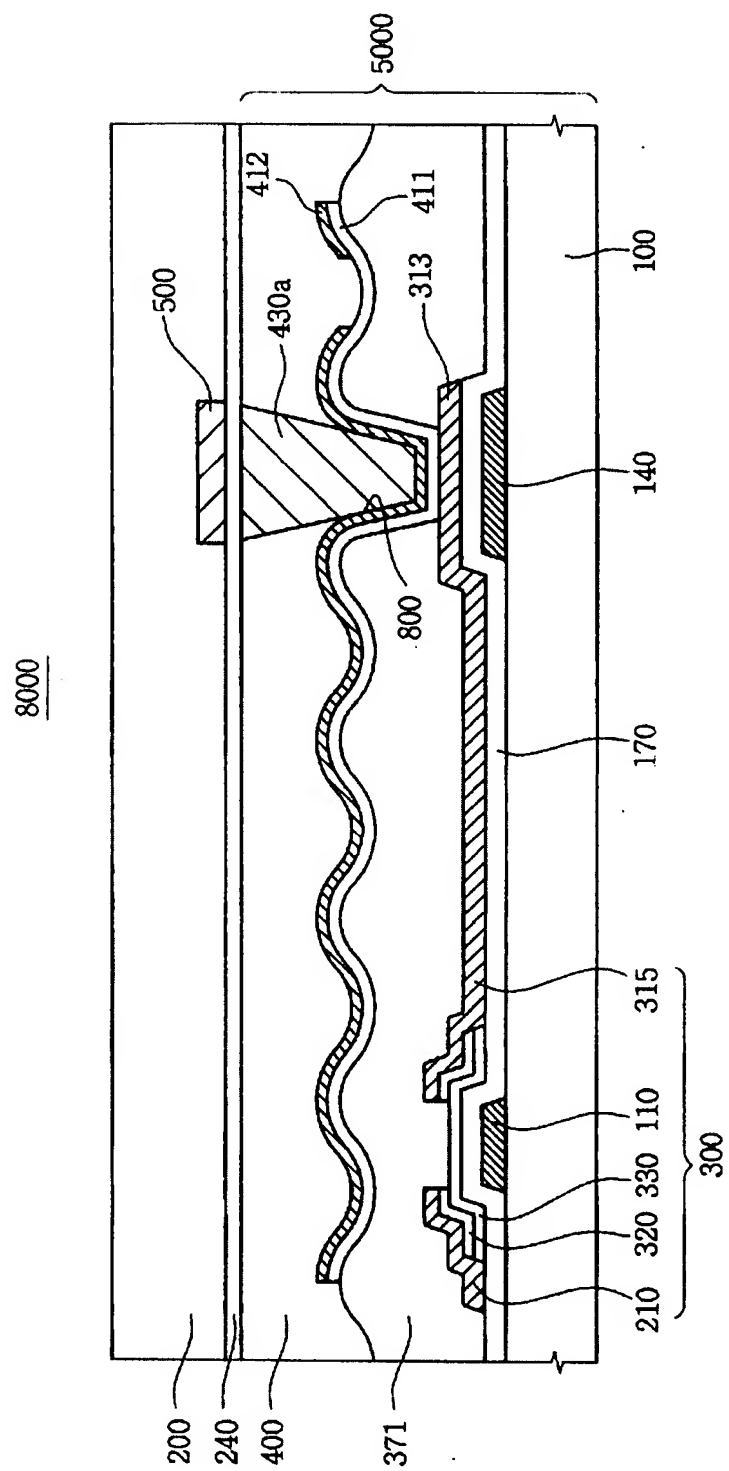
[FIG 2]



[FIG 3]

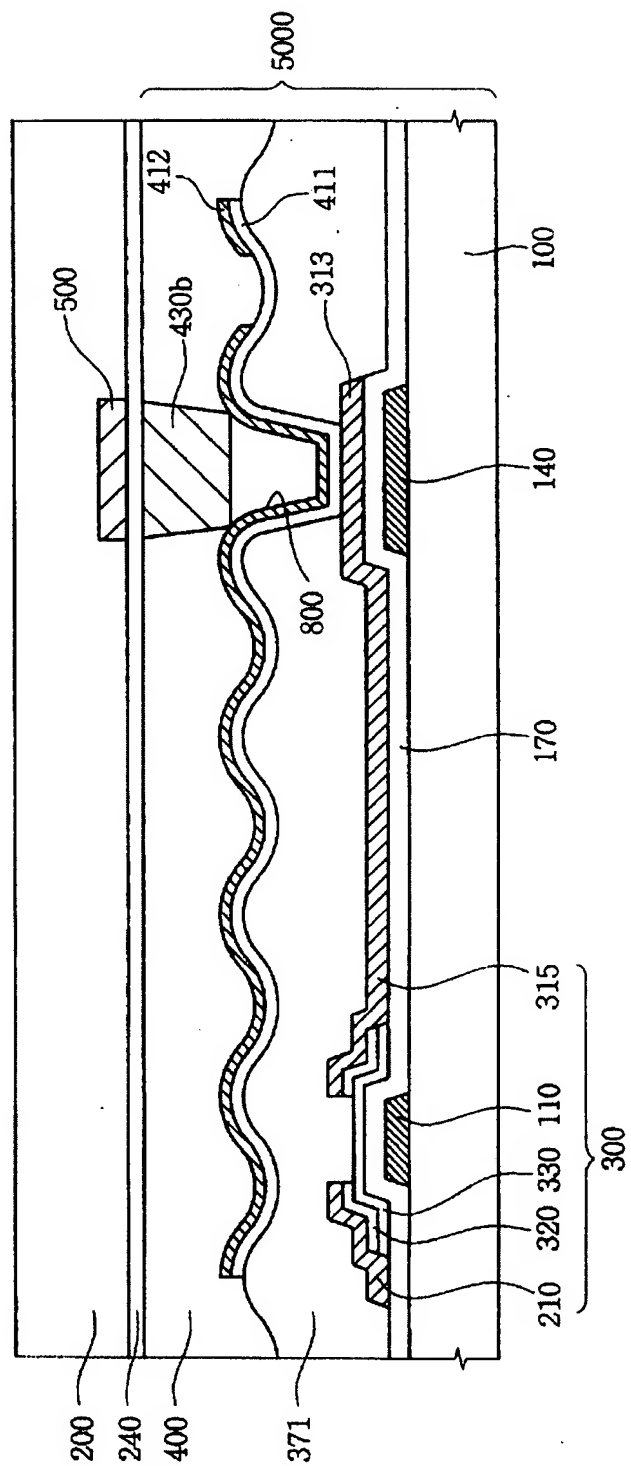


[FIG 4]



[FIG 5]

9000

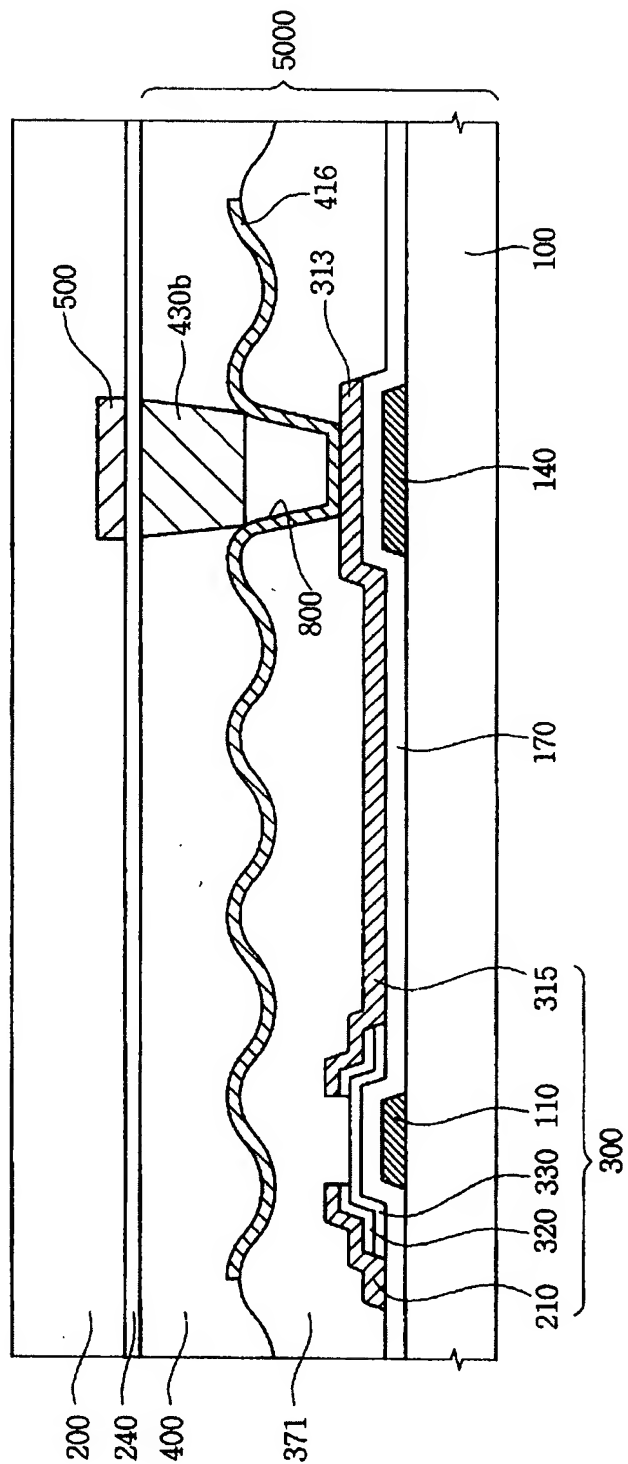


10000

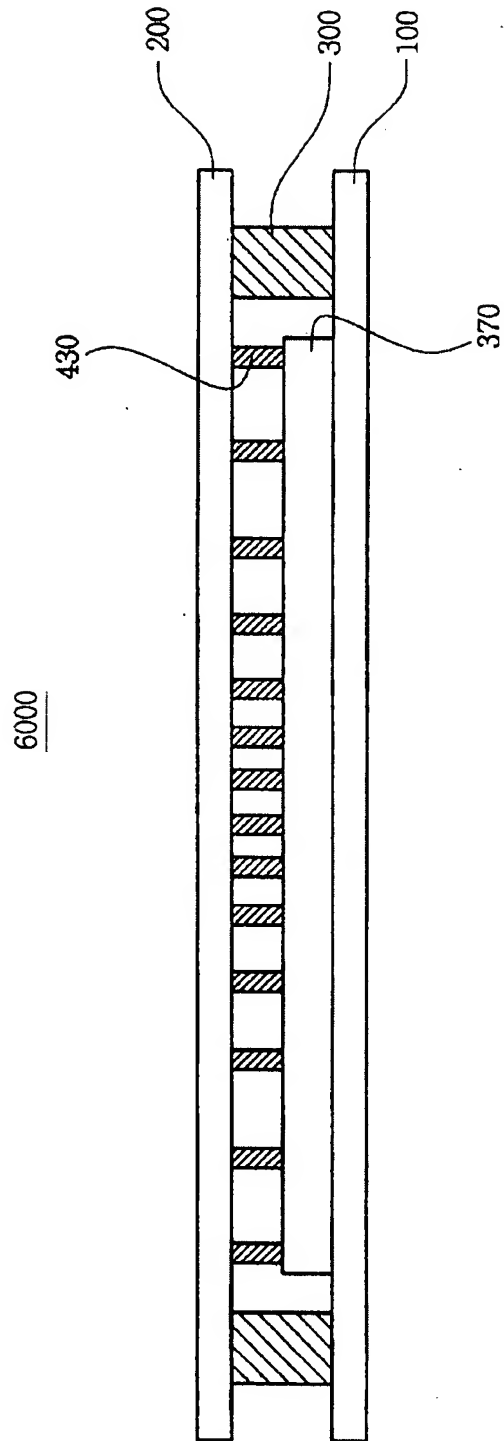


[FIG 7]

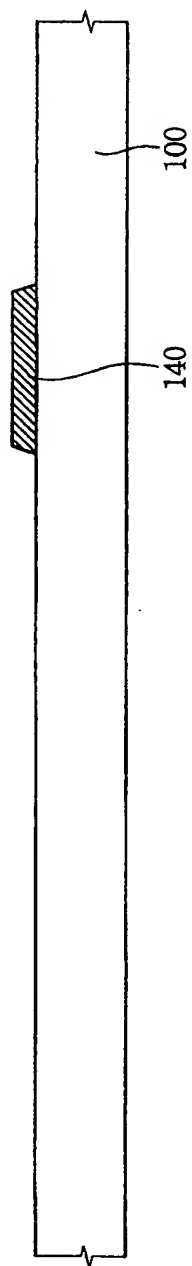
11000



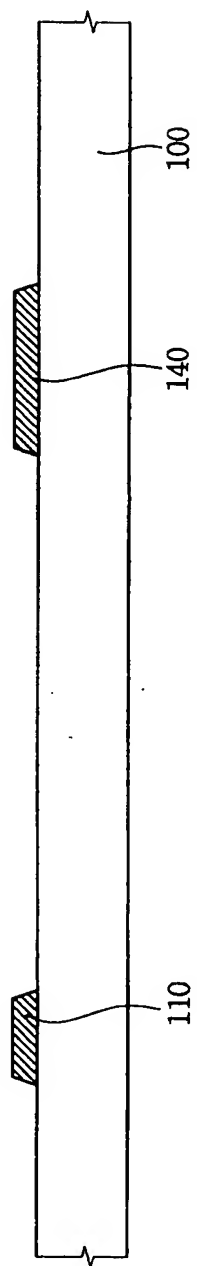
[FIG 8]



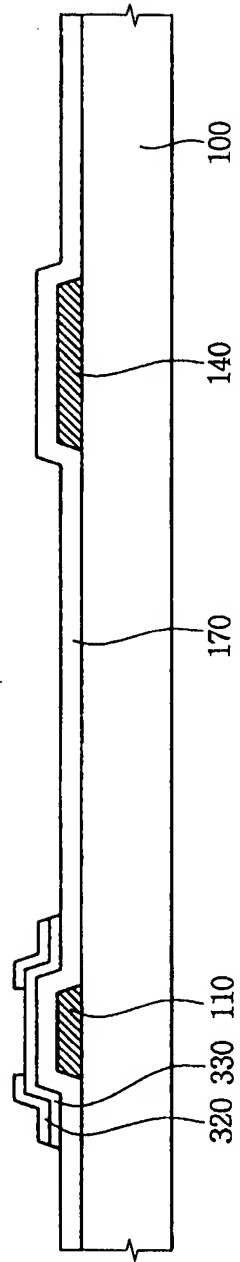
[FIG 9A]



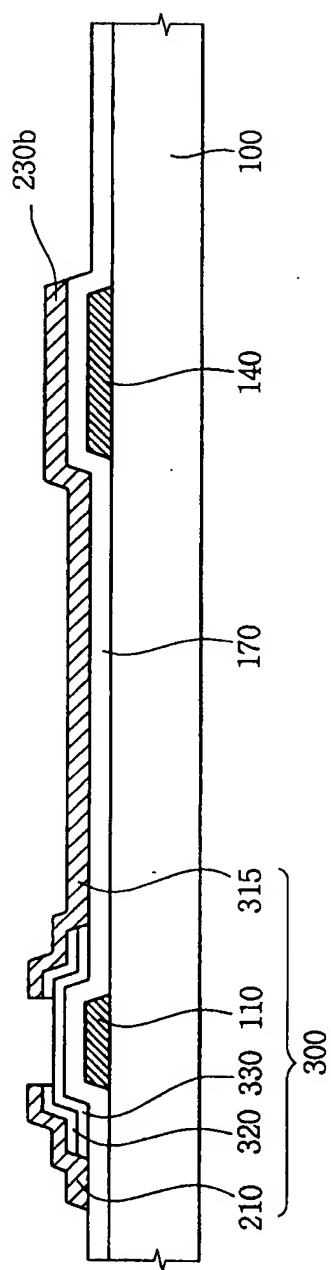
[FIG 9B]



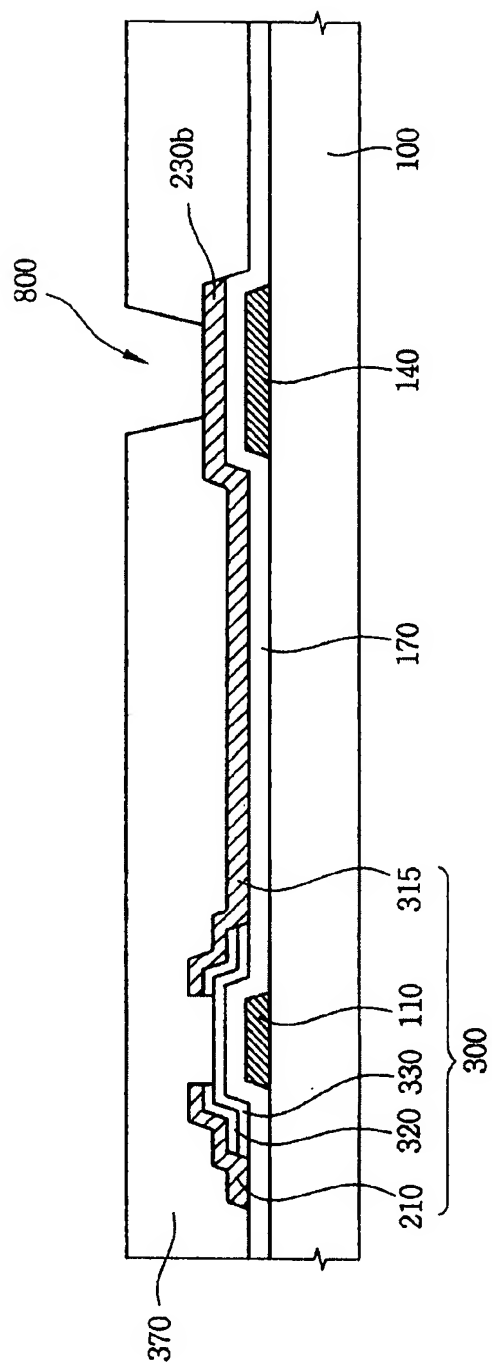
[FIG 9C]



[FIG 9D]



[FIG 9E]



[FIG. 9F]

